REMARKS

This application has been carefully reviewed in light of the Office Action dated March 27, 2003. Claims 1 to 74 are now pending in the application, with Claims 73 and 74 having been added, and Claims 1, 19, 37 and 55 having been amended. Claims 1, 19, 37, 55, 73 and 74 are the independent claims herein. Reconsideration and further examination are respectfully requested.

It is noted that this amendment has been prepared in accordance with the Patent Office's revised format for amendments and therefore, where appropriate, waiver of the requirements of 37 C.F.R. § 1.121 is respectfully requested.

Applicants wish to thank the Examiner for the indication that Claims 5, 23, 41 and 59 would be allowable if rewritten into independent form. Applicants have chosen not to rewrite the claims at this time since the base claims for each of Claims 5, 23, 41 and 59 are believed to be allowable for at least the reasons set forth below.

Claims 1 to 4, 6 to 12, 14, 16, 18 to 22, 24 to 30, 34, 36 to 40, 42 to 48, 50, 52, 54 to 58, 60 to 66, 68, 70 and 72 were rejected under 35 U.S.C. § 103(a) over U.S. Patent No. 6,281,984 (Decker), and Claims 13, 15, 17, 31, 33, 35, 49, 51, 53, 67, 69 and 71 were rejected under § 103(a) over Decker in view of U.S. Patent No. 5,073,818 (Iida). The rejections are respectfully traversed.

The present invention concerns adjusting a color appearance space model to account for mismatch values between humanly perceived device neutrals and the neutral axis of the color appearance space. For example, in a color appearance space, at any given lightness value (J), corresponding values of hue (a*) and chroma (b*) can be determined by measuring a sample color patch. When sample color patches are printed out, at a given lightness level, a human being may perceive a patch as being neutral due to considerations

such as background, surround, etc., (i.e., supposedly having a* and b* values of zero), where in fact, upon mechanical measurement by, for example, a photospectrometer, the perceived neutral patch actually has a* and b* values that are non-zero. Thus, there is a mismatch between the perceived neutral as seen by the human being and the neutral axis for that lightness level. For some types of printers, the mismatch may simply be ignored, but for others, especially bubble-jet printers, the gamut mapping algorithms simply cannot function properly.

Some attempts have been made, however, to adjust the forward mapping in L*a*b* coordinates. For example, in U.S. Patent No. 5,699,491 (Barzel), a copy of which is attached hereto as Exhibit A, a white point adjustment and a black point adjustment are made to measured L*a*b* values. (See Fig. 7 and column 8, line 35 to column 9, line 20.) In addition, a gray axis adjustment is performed according to step S704 in which, for each measured L*a*b* value, its corresponding CMY value is inspected, and if C=M=Y, then a* and b* are set to zero. Otherwise, a* and b* are left unchanged. (See column 9, lines 20 to 46.) Thus, Barzel only sets a* and b* to zero for patches that are printed with equal amounts of C, M and Y ink. However, a viewer may actually perceive a patch printed with unequal amounts of ink as being neutral, but according to Barzel, the a* and b* values for this patch would remain unchanged. The present invention addresses this particular problem in the art.

To address this problem, the invention adjusts the color appearance space to compensate for the mismatch of the perceived device neutral. According to the invention, a forward mapping of sample colors is performed from a device-dependent space to a device-independent color appearance space. The invention then obtains mismatch values for the perceived device-neutrals which are perceived as being neutral by a human being,

where each mismatch value is a difference between a forward mapped value for the device-neutral and a neutral axis of the color appearance space. The mismatch values are then used to create an adjusted forward mapping of the device-independent values for each lightness level of the device-neutrals. As a result, the mappings of perceived device-neutrals are adjusted so as to correspond with the appearance space neutral axis.

With specific reference to the claims, amended independent Claim 1 is a method for adjusting the representation of a device's color gamut in color appearance space, comprising the steps of performing forward mapping of sample colors from a device-dependent space to a device-independent color appearance space to obtain forward-mapped device-independent values, obtaining mismatch values for perceived device-neutrals which are perceived as being neutral by a human being, each mismatch value being a difference between a forward mapped value for the device-neutral and a neutral axis of the color appearance space, and adjusting each forward-mapped device-independent value by utilizing the obtained mismatch value for each corresponding lightness level of device-neutrals in order to obtain an adjusted forward mapping.

Independent Claims 19, 37 and 55 are computer-executable process steps, apparatus, and computer-readable medium claims, respectively, that substantially correspond to Claim 1.

Newly-added Claims 73 and 74 include features along the lines Claims 1, 19, 37 and 55, but vary somewhat in scope. Thus, newly-added Claim 73 is an image processing method, comprising the steps of transforming a color measurement value to a device-independent color appearance space value, generating a forward mapping model by using the transformed device-independent color appearance space value, selecting a neutral color in the forward mapping model and adjusting the forward mapping model based on a

difference between a device-independent color appearance space value of the selected neutral color and a neutral axis, and inverting the adjusted forward mapping model and generating an inverted forward mapping model, the inverted forward mapping model transforming a device-independent color appearance space value into a device dependent value.

Newly-added Claim 74 is a memory medium claim that substantially corresponds to Claim 73.

The applied art, alone or in combination, is not seen to disclose or to suggest the features of Claims 1, 19, 37, 55, 73 and 74. In particular, with regard to Claims 1, 19, 37 and 55, the applied art is not seen to disclose or to suggest at least the feature of obtaining mismatch values for perceived device-neutrals which are perceived as being neutral by a human being, each mismatch value being a difference between a forward mapped value for the device-neutral and a neutral axis of the color appearance space, and adjusting each forward-mapped device-independent value by utilizing the obtained mismatch value for each corresponding lightness level of device-neutrals in order to obtain an adjusted forward mapping. With regard to Claims 73 and 74, the applied art is not seen to disclose or to suggest at least the feature of selecting a neutral color in a forward mapping model, which maps a color measurement value to a device-independent color appearance space value, and adjusting the forward mapping model based on a difference between a device-independent color appearance space value of the selected neutral color and a neutral axis.

Decker is merely seen to disclose a process for mapping from one CMYK (device-dependent) space (such as the SWOP standard) to another C'M'Y'K' space (such as for a specific printer). The CMYK and C'M'Y'K' (which is a device dependent space)

is mapped to a device-independent color space (CIELAB) to map CMYK and C'M'Y'K' to Lab values. The Lab values of each device independent-color space are compared so that, for example, using a given L (lightness) value, the K of the SWOP standard can be mapped to find the K' of the same L in the printer standard. Thus, in Decker's process, only L values are used and it is assumed that the a* and b* values for the L are zero. Therefore, Decker does not consider any mismatches that may be present in the a* and b* values. That is, Decker does not take into consideration a human viewer's perception of which color patches appear to neutral to the viewer and find mismatches between the perceived neutrals. Thus, in Decker, no mismatch values are obtained for perceived device neutrals and no forward mapped device independent color appearance space values are adjusted using the obtained mismatch values.

To emphasize this point, Decker explicitly states that no mismatches are present, or that if they are present, they are simply ignored. Specifically, Decker states: "The printer prints a series of greyscale fourth colorant (e.g., black)(Kp) patches, 102. Since the values of a* and b* are approximately zero for the greyscale black patches, only the L* value is used for the greyscale black patches. [] Using this L* value, the percentage of K' of the printer will be determined that equals this L value." (See column 9, lines 26 to 30; 37 to39). Thus, since Decker is mapping from one dependent CMYK space to another, it does not care where in a color appearance space any individual color, such as a device neutral, falls. In contrast, the present invention specifically obtains mismatches (i.e., looks where the device neutral falls with regard to the neutral axis) and then adjusts the forward mapping to compensate for the mismatches. Decker simply uses unadjusted Lab values to determine the corresponding percentage of ink needed in the destination C'M'Y'K' space. Therefore, contrary to the allegation made in the Office Action, Decker simply does not

disclose or suggest obtaining mismatch values for perceived device-neutrals which are perceived as being neutral by a human being, each mismatch value being a difference between a forward mapped value for the device-neutral and a neutral axis of the color appearance space, and adjusting each forward-mapped device-independent value by utilizing the obtained mismatch value for each corresponding lightness level of device-neutrals in order to obtain an adjusted forward mapping (Claims 1, 19, 37 and 55), or at least the feature of selecting a neutral color in a forward mapping model, which maps a color measurement value to a device-independent color appearance space value, and adjusting the forward mapping model based on a difference between a device-independent color appearance space value of the selected neutral color and a neutral axis (Claims 73 and 74).

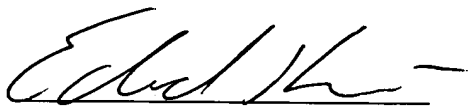
Iida is not seen to add anything to overcome Decker's deficiencies. In particular, Iida is not seen to disclose or to suggest obtaining mismatch values for perceived device-neutrals which are perceived as being neutral by a human being, each mismatch value being a difference between a forward mapped value for the device-neutral and a neutral axis of the color appearance space, and adjusting each forward-mapped device-independent value by utilizing the obtained mismatch value for each corresponding lightness level of device-neutrals in order to obtain an adjusted forward mapping (Claims 1, 19, 37 and 55), or at least the feature of selecting a neutral color in a forward mapping model, which maps a color measurement value to a device-independent color appearance space value, and adjusting the forward mapping model based on a difference between a device-independent color appearance space value of the selected neutral color and a neutral axis (Claims 73 and 74).

In view of the foregoing deficiencies of the applied art, independent Claims 1, 19, 37, 55, 73 and 74, as well as the claims dependent therefrom, are believed to be in condition for allowance and such action is respectfully requested at the Examiner's earliest convenience.

As a formal matter, in accordance with 37 C.F.R. § 1.56, Applicants wish to direct the Examiner's attention to the attached document, U.S. Patent No. 5,699,491. This document is not being cited in an Information Disclosure Statement at this time since Applicants are not able to comply with the requirements of 37 C.F.R. § 1.97(d) by not being able to make the statement under § 1.97(e). Nonetheless, consideration of U.S. Patent No. 5,699,491 is respectfully requested.

Applicants' undersigned attorney may be reached in our Costa Mesa, California office at (714) 540-8700. All correspondence should continue to be directed to our below-listed address.

Respectfully submitted,



Attorney for Applicants
Registration No. 42,746

FITZPATRICK, CELLA, HARPER & SCINTO
30 Rockefeller Plaza
New York, New York 10112-2200
Facsimile: (212) 218-2200
CA_MAIN 64425 v 1